

DAEMON TECHNOLOGY



Those who have been watching the old five-part *Dr Who* story *The Daemons* may have spotted the four out of five parts that have been reclaimed from the BBC's

video graveyard, by technology worthy of the time lords themselves.

The Daemons was first broadcast in May 1971. Jon Pertwee, who then played the Doctor, later said it was his favourite story. Unusual for the time, it contained many expensive external location scenes.

The story ended with a church being blown up and this produced a string of letters to the *Radio Times* complaining of sacrilege.

In 1971 the BBC videotaped *The Daemons* in colour, using the only professional video recorders available at the time, Ampex Quad recorders which scanned 2in. (50mm) tape with four heads. But in the mid '70s the BBC had an economy drive and erased large numbers of Quad tapes for re-use, and all but one episode of *The Daemons* (Part 4) was wiped.

Before erasure, the BBC had made two copies. One was in colour onto US standard NTSC tape, for sale to North American TV stations. The Americans heavily edited the tape before transmission, to speed up the action by removing subtle pauses, and cut running time to make room for commercials.

The edited version was broadcast in 1977 and the tape wiped.

The BBC's other copy was onto black and white 16mm film, made by photographing a high-quality monochrome TV picture tube with a movie camera. The film copy was sold by BBC Enterprises to African countries which were not then broadcasting colour TV.

Ten years later, when *Dr Who* had become a cult series, the BBC realised it had only a black and white copy of *The Daemons*. But, by a stroke of luck, a British *Dr Who* fan had in April 1978 met an American *Dr Who* fan who had made an off-air recording of the US transmission, using one of Sony's first Betamax 1

(one hour) NTSC home video machines.

The British fan paid to have the Betamax tapes transferred to industrial U-matic cassettes, still in NTSC. The BBC got hold of these cassettes and asked James Russell, a video systems designer with British company Rank-Cintel, and a *Dr Who* fan, if it might be possible to do something with them.

Off-air domestic recordings are never good enough to re-broadcast, and modern TV viewers don't want to watch black and white versions of colour programmes. So James Russell joined forces with BBC graphics designer Ralph Montagu — another *Dr Who* fan — to find a way of blending the colour (chroma) signal from the NTSC recording with the monochrome (luminance) detail from the film.

The restoration process

Working in the BBC Current Affairs video editing facility, Russell and Montagu first ran the 16mm film through a telecine machine. This generated a video luminance signal which was recorded onto a modern Betacam tape recorder.

Next they converted the NTSC tape to PAL standard, and recorded that onto another Betacam tape. The two tapes were then locked together by digital timecode and played in synchronisation, with the PAL colour signal from one tape mixed with the luminance signal from the other.

This revealed geometrical distortion of the luminance signal, caused by the original photographic process, because the geometry of a TV picture on a cathode ray tube can never be perfect.

To allow for this, the signals were converted into digital code and processed by a special effects unit, of the type which allows programme producers to distort pictures for dramatic effect. In this case the effects unit was used to distort the picture back into its correct shape, so that the colour and luminance images matched exactly.

The biggest challenge was to reconstitute sequences which, because of US editing, existed only in black and white.

The engineers did this by adding

HOURS OF HARD WORK AND TOP-NOTCH TECHNOLOGY AT THE BBC LIE BEHIND THE RESTORING TO BROADCAST QUALITY OF THE FIVE-PART *DR WHO* STORY, *THE DAEMONS*



colour by hand with a Paintbox special effects unit, using what remained of the uncut original scene as a guide. One 20-second scene took two hours to rebuild.

In all, James Russell and Ralph Montagu spent at least 40 hours rebuilding the 125-minute series.

Now the system has been proved to work, the BBC — which has a large library of black and white film material — is looking for matching off-air tapes to use in the same way ○

Parts 4 and 5 of The Daemons are transmitted on BBC2 on Friday December 11 and 18.